Amendments to Claims

1. (Currently Amended) A process for producing a polymer comprising:

conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to one or more hybrid reactors maintained at effective hybrid polymerization temperatures and sub-reflux polymerization gage pressures to cause polymerization of a portion of said hybrid reactor monomers into said polymer; and

conveying hybrid reactor contents to one or more batch reactors maintained at effective batch polymerization temperatures and reflux polymerization gage pressures to cause polymerization of a remaining portion of said hybrid reactor monomers into said polymer.

2. (Original) The process of claim 1 wherein said hybrid reactor mixture comprises a polymerization medium.

3. (Currently Amended) The process of claim 2 wherein said polymerization medium comprises one or more components selected from the group consisting of organic solvents, an aqueous medium, ~~or~~ and a polymeric component.

4. (Original) The process of claim 3 wherein said organic solvent is selected from the group consisting of acetone, methyl amyl ketone, methyl ethyl ketone, an aromatic solvent blend, xylene, toluene, ethyl acetate, n-butyl acetate, t-butyl acetate, butanol, glycol ether, and combination thereof.

5. (Currently Amended) The process of claim 3 wherein said aqueous medium comprises water, or an aqueous solution of water and a water miscible solvent.

6. (Original) The process of claim 3 wherein said polymeric component comprises a polyester, acrylic polymer, or a mixture thereof solvated or dispersed in one or more said organic solvents or said aqueous medium.

7. (Original) The process of claim 1 further comprising conveying a polymerization medium to said hybrid reactors before said hybrid reactor mixtures are conveyed to said hybrid reactors.

8. (Original) The process of claim 1 wherein an excess portion of said hybrid reactor contents is conveyed to said batch reactors once said hybrid reactors are filled to preset levels.

9. (Original) The process of claim 1 wherein said hybrid reactors are stirred tank reactors.

10. (Original) The process of claim 1 wherein said hybrid polymerization temperatures range from 80°C to 400°C.

11. (Previously Presented) The process of claim 1 wherein said sub-reflux polymerization gage pressures in said hybrid reactors range from 0 to 2.76 MPa (0 to 400 psig).

12. (Original) The process of claim 1 wherein said portion of said monomers polymerized in said hybrid reactors ranges from 30 weight percent to 99 weight percent, all based on the total amount of monomers conveyed to said hybrid reactors.

13. (Original) The process of claim 1 comprising conveying inert gas in vapor space in said hybrid reactors.

14. (Original) The process of claim 13 wherein said inert gas is nitrogen, argon, carbon dioxide or a mixture thereof.

15. (Original) The process of claim 1 wherein batch reactor contents comprise a polymerization medium.

16. (Original) The process of claim 15 wherein said polymerization medium comprises one or more organic solvents, or an aqueous medium.

17. (Original) The process of claim 1 further comprising conveying one or more said initiators to said batch reactors.

18. (Original) The process of claim 1 or 17 further comprising conveying one or more said monomers to said batch reactors.

19. (Original) The process of claim 1 further comprising conveying a polymerization medium to said batch reactors before said hybrid reactor contents are conveyed to said batch reactors.

20. (Original) The process of claim 1 wherein said batch reactors are stirred tank reactors.

21. (Original) The process of claim 1 wherein said batch polymerization temperatures range from 80°C to 300°C.

22. (Previously Presented) The process of claim 1 wherein said reflux polymerization pressures in said batch reactors are at an atmospheric pressure.

23. (Original) The process of claim 1 comprising conveying inert gas in vapor space in said batch reactors.

24. (Original) The process of claim 1 wherein a solution of said hybrid reactor initiators in a polymerization medium is conveyed to said hybrid reactors.

25. (Original) The process of claim 1 wherein said hybrid reactor monomers are selected from the group consisting of (meth)acrylate monomers, functional (meth)acrylic monomers, acid monomers, nitrile monomers, styrene, styrenic monomers, amide monomers, silyl monomers, vinyl monomers, and a combination thereof.

26. (Original) The process of claim 1 wherein said initiators comprise redox initiators, thermal initiators, photochemical initiators, or a combination thereof.

27. (Original) The process of claim 1 further comprising conveying a portion or all of said hybrid reactors contents to said batch reactors when preset unsafe hybrid reactor pressures are reached.

28. (Original) The process of claim 2 further comprising rinsing said hybrid reactors with a chaser portion of the polymerization medium after all of the hybrid reactor contents had been conveyed to batch reactors; and

conveying said chaser portion to said batch reactors.

29. (Original) The process of claim 1 wherein said polymer is an acrylic polymer, a blend of an acrylic polymer and polyester, microgel, homopolymer, copolymer, block copolymer, graft copolymer, comb copolymer, branched copolymer, branch-upon-branch copolymer, non-aqueous polymer dispersion, star polymer, oligomer, and a ladder copolymer.

30. (Original) A polymer made by the process of claim 1 or 29.

31. (Original) A coating composition comprising a polymer made by the process of claim 1 or 29.

32. (Currently Amended) A process for producing a polymer comprising:

conveying a hybrid reactor mixture comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to a hybrid reactor maintained at an effective hybrid polymerization temperature and sub-reflux polymerization gage pressure to cause polymerization of substantial amount of said hybrid reactor monomers into said polymer; and

conveying hybrid reactor contents to a batch reactor maintained at an effective batch polymerization temperature and reflux polymerization gage pressure to cause polymerization of remaining amount of said hybrid reactor monomers into said polymer.

33. (Currently Amended) A process for producing a graft copolymer comprising:

conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to one or more hybrid reactors maintained at effective hybrid polymerization temperatures and sub-reflux polymerization gage pressures to cause polymerization of said hybrid monomers into macromonomers;

conveying hybrid reactor contents to one or more batch reactors maintained at effective batch polymerization temperatures and reflux polymerization gage pressures; and

conveying batch reactor mixtures comprising one or more batch reactor monomers and one or more batch reactor initiators to cause polymerization of said batch reactor monomers into a backbone of said graft copolymer having said macromonomers grafted onto said backbones.

34. (Original) The process of claim 33 comprising conveying on or more chain transfer catalysts to provide said macromonomers with an unsaturated terminal group.

35. (Original) The process of claim 34 wherein said chain transfer catalyst is diaquabis(borondifluorodimethylglyoximato)cobaltate(II), diaquabis(borondifluorodiphenylglyoximato)cobaltate (II), pentacyanocobaltate (II), or a combination thereof.

36. (Original) The process of claim 33 wherein said hybrid reactor contents and said batch reactor mixtures are conveyed simultaneously to said batch reactors or said hybrid reactor contents are conveyed to said batch reactors after said conveying of a portion or all of said batch reactor monomers to said batch reactors.

37. (Original) The process of claim 36 wherein a portion or all of said batch reactor initiators is conveyed simultaneously with said batch reactor monomers or with said hybrid reactor contents to said batch reactors.

38. (Original) The process of claim 36 further comprising conveying a polymerization medium to said hybrid reactors, said batch reactors; or to said hybrid and batch reactors before conveying said hybrid reaction mixtures to said hybrid reactors.

39. (Original) The process of claim 36 further comprising conveying a polymerization medium to said hybrid reactors before conveying said hybrid reaction mixtures to said hybrid reactors.

40. (Original) The process of claim 36 further comprising conveying a polymerization medium to said batch reactors before conveying said hybrid reactor contents to said batch reactors.

41. (Original) The process of claim 36 further comprising conveying a polymerization medium to said batch reactors before conveying said batch reactor mixtures to said batch reactors.

42. (Original) The process of claim 36 further comprising conveying a polymerization medium to said batch reactors before conveying said batch reactor mixtures and said hybrid reactors contents to said batch reactors.

43. (Original) The process claim 36, 37, 38, 39, 40, 41 or 42 wherein a solution of said hybrid reactor initiators in a portion of said polymerization medium is conveyed to said hybrid reactors.

44. (Original) The process claim 36, 37, 38, 39, 40, 41 or 42 wherein a solution of said batch reactor initiators in a portion of said polymerization medium is conveyed to said batch reactors.

45. (Original) The process claim 36, 37, 38, 39, 40, 41 or 42 wherein a solution of said hybrid reactor initiators in a portion of said polymerization medium is conveyed to said hybrid reactors; and a solution of said batch reactor initiators in another portion of said polymerization medium is conveyed to said batch reactors.

46. (Original) A process for producing a polymer blend comprising:

conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to one or more hybrid reactors maintained at effective hybrid polymerization temperatures and sub-reflux polymerization gage pressures to cause polymerization of said hybrid monomers into a hybrid reactor polymer;

conveying hybrid reactor contents to one or more batch reactors maintained at effective batch polymerization temperatures and reflux pressures; and

conveying batch reactor mixtures comprising one or more batch reactor monomers and one or more batch reactor initiators to cause polymerization of said batch reactor monomers into a reactor polymer to form said polymer blend.

47. (Withdrawn) A polymerization system comprising:

means for conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to one or more hybrid reactors;

means for maintaining said hybrid reactors at effective hybrid polymerization temperatures and means for maintaining said hybrid reactors at sub-reflux polymerization gage pressures to cause polymerization of a portion of said hybrid reactor monomers into a polymer;

means for conveying hybrid reactor contents from said hybrid reactors to one or more batch reactors;

means for conveying batch reactor mixtures comprising one or more batch initiators to one or more batch reactors; and

means for maintaining said batch reactors at effective batch polymerization temperatures and means for maintaining said batch reactors at reflux polymerization pressures to cause polymerization of remaining portion of said hybrid reactor monomers into said polymer.

48. (Withdrawn) The polymerization system of claim 47 comprising means for conveying a polymerization medium to said hybrid reactors.

49. (Withdrawn) The polymerization system of claim 47 comprising means for conveying a polymerization medium to said batch reactors.

50. (Withdrawn) The polymerization system of claim 47 comprising means for agitating said hybrid reactor mixtures in said hybrid reactors.

51. (Withdrawn) The polymerization system of claim 47 comprising means for agitating said batch reactor mixtures in said batch reactors.

52. (Withdrawn) The polymerization system of claim 47 comprising means for relieving pressure in said hybrid reactors.

53. (Withdrawn) The polymerization system of claim 47 comprising means for relieving pressure in said batch reactors.

54. (Withdrawn) The polymerization system of claim 47 comprising means for conveying one or more inert gases in a vapor space in said hybrid reactors.

55. (Withdrawn) The polymerization system of claim 47 comprising means for conveying one or more inert gases in a vapor space in said batch reactors.

56. (Withdrawn) The polymerization system of claim 47 comprising:
means for detecting the mass reactor contents present in said hybrid reactors and
means generating signal to open a controllable valve to convey of an excess portion of the hybrid reactor contents to said batch reactor system.

57. (Withdrawn) A polymerization system comprising:

means for conveying first hybrid reactor mixtures comprising one or more first hybrid reactor monomers and one or more first hybrid reactor initiators to a first hybrid reactor;

means for maintaining said first hybrid reactor at effective first hybrid polymerization temperature and means for maintaining said first hybrid reactor at first sub-reflux polymerization gage pressure to cause polymerization of a portion of said first hybrid reactor monomers into a polymer;

means for conveying second hybrid reactor mixtures comprising one or more second hybrid reactor monomers and one or more second hybrid reactor initiators to second hybrid reactor;

means for maintaining said second hybrid reactor at effective second hybrid polymerization temperature and means for maintaining said second hybrid reactor at second sub-reflux polymerization gage pressure to cause polymerization of another portion of said first hybrid reactor monomers and a portion of said second hybrid reactor monomers into said polymer;

means for conveying first hybrid reactor contents from said first hybrid reactor to a batch reactor;

means for conveying second hybrid reactor contents from said second hybrid reactor to said batch reactor;

means for conveying batch reactor mixtures comprising one or more batch initiators to said batch reactor; and

means for maintaining said batch reactor at effective batch polymerization temperature and means for maintaining said batch reactor at reflux polymerization pressure to cause polymerization of remaining portions of said first and second hybrid reactor monomers into said polymer.

58. (Withdrawn) A polymerization system comprising:

means for conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers and one or more hybrid reactor initiators to a hybrid reactor;

means for maintaining said hybrid reactor at effective hybrid polymerization temperature and means for maintaining said hybrid reactor at sub-reflux polymerization gage pressure to cause polymerization of a portion of said hybrid reactor monomers into a polymer;

means for conveying portions of hybrid reactor contents from said hybrid reactor to a first and a second batch reactor;

means for conveying first batch reactor mixture comprising one or more batch initiators to said first batch reactor;

means for conveying second batch reactor mixture comprising one or more batch initiators to said second batch reactor;

means for maintaining said first batch reactor at effective first batch polymerization temperature and means for maintaining said first batch reactor at reflux polymerization

pressure to cause polymerization of the portion of said hybrid reactor monomers conveyed from said hybrid reactor into said polymer; and

means for maintaining said second batch reactor at effective second batch polymerization temperature and means for maintaining said second batch reactor at reflux polymerization pressure to cause polymerization of the portion of said hybrid reactor monomers conveyed from said hybrid reactor into said polymer.

59. (Withdrawn) A polymerization system comprising:

means for conveying first hybrid reactor mixtures comprising one or more first hybrid reactor monomers and one or more first hybrid reactor initiators to a first hybrid reactor;

means for maintaining said first hybrid reactor at effective first hybrid polymerization temperature and means for maintaining said first hybrid reactor at first sub-reflux polymerization gage pressure to cause polymerization of a portion of said first hybrid reactor monomers into a polymer;

means for conveying first hybrid reactor contents from said first hybrid reactor to a second hybrid reactor;

means for conveying second hybrid reactor mixtures comprising one or more second hybrid reactor monomers and one or more second hybrid reactor initiators to second hybrid reactor;

means for maintaining said second hybrid reactor at effective second hybrid polymerization temperature and means for maintaining said second hybrid reactor at second sub-reflux polymerization gage pressure to cause polymerization of another portion of said first hybrid reactor monomers and a portion of said second hybrid reactor monomers into said polymer;

means for conveying second hybrid reactor contents from said second hybrid reactor to a batch reactor;

means for conveying batch reactor mixtures comprising one or more batch initiators to said batch reactor; and

means for maintaining said batch reactor at effective batch polymerization temperature and means for maintaining said batch reactor at reflux polymerization pressure to cause polymerization of remaining portions of said first and second hybrid reactor monomers into said polymer.

60. (Previously Presented) The process of claim 2 further comprising:

rinsing said hybrid reactors with a chaser portion of said polymerization medium after all of said hybrid reactor contents have been conveyed to said batch reactors; and

conveying said chaser portion to said batch reactors.

61. (Previously Presented) The process of claim 1 wherein said hybrid polymerization temperatures range from 120°C to 300°C.

62. (Previously Presented) The process of claim 1 wherein said batch polymerization temperatures range from 100°C to 250°C.

63. (Previously Presented) A process for producing a polymer comprising:

conveying hybrid reactor mixtures comprising one or more hybrid reactor monomers solvated in a polymerization medium and one or more hybrid reactor initiators to one or more hybrid reactors maintained at effective hybrid polymerization temperatures and sub-reflux polymerization gage pressures to cause polymerization of a portion of said hybrid reactor monomers into said polymer; and

conveying hybrid reactor contents to one or more batch reactors maintained at effective batch polymerization temperatures and reflux polymerization pressures to cause polymerization of a remaining portion of said hybrid reactor monomers into said polymer.

64. (Currently Amended) The process of claim 63 wherein said polymerization medium comprises one or more organic solvents.

65. (New) The process of claim 1 wherein said hybrid polymerization occurs in a single hybrid reactor and wherein said batch polymerization occurs in a single batch reactor.

66. (New) The process of claim 61 wherein said hybrid polymerization temperatures range from 140° C to 220° C.

67. (New) The process of claim 62 wherein said batch polymerization temperatures range from 120° C to 200° C.

68. (New) The process of claim 66 wherein the hybrid polymerization gage pressures range from 0.1 to 2.76 MPa (0-400 psig).

69. (New) The process of claim 68 wherein said hybrid polymerization gage pressures range from 0.1 to 0.69 MPa (0-100 psig).

70. (New) The process of claim 67 wherein the batch gage pressures range from 0.1-2.76 MPa (0-400 psig).

71. (New) The process of claim 70 wherein said batch gage pressures range from 0.1-0.69 MPa (0-100 psig).

72. (New) The process of claim 1 wherein the polymer is an acrylic polymer having a GPC weight average molecular weight of from about 6,000 to about 20,0000.

73. (New) The process of claim 1 wherein the polymer is an acrylic polymer having a GPC weight average molecular weight of from about 8,000 to about 12,000.

74. (New) The process of claim 1 wherein said one or more hybrid reactor initiators comprise no more than about 2% by weight of the hybrid reactor mixtures.